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SHEET METAL CABLE HOOK

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3 The present application is related to provisional patent application serial
4 number 60/363,250 entitled "Sheet Metal Cable Hook" filed on March 12, 2002,
5 priority from which is hereby claimed.

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FIELD OF THE INVENTION

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8 The present invention relates to self-clinching fastener that provides a
9 permanent location for removably attaching items such as a wiring or fiber-optic
10 bundle.

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BACKGROUND OF THE INVENTION

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12 Electrical equipment quite often has the signal and/or power distribution
13 wiring-bundle routed around the inside of a metal cabinet. It is important that this
14 wiring-bundle be secured in a specific location inside the cabinet to ensure that
15 mechanical and electrical interference concerns are properly addressed. It is further
16 desirable to have the outside of the cabinet flush and sealed for environmental and
17 electrical interference reasons. It is yet further desirable that the wiring-bundle can be
18 temporarily relocated with minimal risk of damage.

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19 The known attachment methods do not adequately address these requirements
20 and have several shortcomings. One known attachment method is to mount an
21 adhesive based element to a flat surface and then use this mount to secure the wiring-
22 bundle with a permanent plastic cable-tie. However, the adhesive mount is subject to
23 failure and high temperatures or temperature variations can cause adhesive bond to

1 deteriorate and release. Furthermore, this attachment method does not allow for easy
2 removal of the wiring-bundle for maintenance. Another known attachment means for
3 mounting cables includes snapping a plastic mount through a hole in the exterior of the
4 panel, however because this type of plastic mount protrudes through the outside of the
5 panel it is not flush. Threaded fastening devices have been employed to mount cables,
6 however they must be inserted from the outside of the cabinet and then through the
7 mounting device on the inside which is often awkward and may require two people to
8 perform. In yet another attachment method, prior art clinch fasteners have been used
9 to provide the required smooth metallic outer surface for the cabinet, however they
10 only provide a walled hole on the inside through which the wiring-bundle cable-tie
11 must be passed. This permanently attaches the wiring-bundle and if the wiring-bundle
12 needs to be temporarily repositioned the cable-tie needs to be cut, posing risk of
13 damage to the wiring-bundle during the cutting operation and further requiring a new
14 cable-tie for reassembly.

15 It is therefore an object of the present invention to provide a permanently
16 mounted fastener that establishes a fixed location for securing a wiring-bundle while
17 allowing for its easy removal and repositioning. It is yet another object of the present
18 invention to provide an attachment mounting for a wire-bundle cable-tie which permits
19 the cable-tie to be easily removed. It is another object of the present invention to
20 provide a hook-type wire-bundle holder which prevents the inadvertent removal of the
21 cable-tie. It is a further object of the invention to provide a panel-mounted fastener
22 that can releaseably secure a variety of different items such as springs, rods, tubing, or

1 shafts. It is yet a further object of the invention to provide a hook-type mounting
2 which provides abrasion resistance and electrical insulation.

3 **SUMMARY OF THE INVENTION**

4 The present invention is a metal fastener which is permanently clinched into a
5 rectangular hole in a metallic panel such as the wall of a metal cabinet. The clinching
6 process ensures a flush, permanent, sealed metallic outer surface which can be
7 cosmetically finished with the same process, such as painting, used to finish the rest of
8 the cabinet. A portion of the fastener protruding on the inner surface of the cabinet
9 includes a hook of specific shape and size. The lateral opening of the hook allows an
10 industry standard screw-mount cable-tie to be placed through the opening from the
11 side.

12 More specifically, the applicant has invented a cable hook having a self-
13 clinching attachment means which includes a substantially rectangular base having a
14 planar bottom surface and further including panel attachment means located on
15 opposing front and rear side surfaces thereof. A hook portion extends upwardly from
16 the base, the hook portion including upper and lower jaws forming a substantially C-
17 shaped hook with a frontal opening located between spaced ends of the jaws. The C-
18 shaped hook has a lateral opening that is substantially circular. The cable hook further
19 includes a single laterally extending notch on the inside surface of the upper jaw
20 proximate the frontal opening. The jaws have a continuous arcuate inside surface
21 except for the notch. The base includes orientation marks on the bottom planar
22 surface thereof proximate only one of the front or rear sides. The panel attachment

1 means are deformer undercut grooves for receiving the cold flow of metal from a
2 panel attached thereby.

3 In alternate embodiments, a metal or electrically non-conductive thermoplastic
4 insert encompasses the inside surface of the jaws and partially encompasses the lateral
5 sides of the fastener adjacent the lateral opening, covering the edges of the jaws. A
6 pivotable flap lies across the frontal opening to positively retain items held within the
7 hook. The flap is unitary with the insert and resiliently biased toward a closed
8 position.

9 In another embodiment, a spring-biased catch covers the frontal opening of the
10 fastener to positively retain items held within the hook. The insert has two opposing
11 ears which have inward-facing dimples that engage cooperating recesses on opposite
12 sides of the lower jaw to provide a pivot for the catch. A tail portion of the insert is
13 free to slide against the inside surface of the lower jaw to provide a spring force to
14 close the catch.

15 When using the invention, the cable-tie is placed around the wiring-bundle and
16 secured in the normal manner. If the wiring-bundle must be temporarily relocated, the
17 cable-tie can be removed from the front of the fastener through a gap between the
18 jaws of the hook without unbundling the wires. Re-attachment of the wiring-bundle is
19 readily accomplished by reversing the process from the front end of the hook. No new
20 cable-ties are required and the risk of damaging the wiring-bundle during a
21 removal/cutting operation is eliminated. The fastener shape and opening size retain
22 the cable-tie in many positions yet allow for its easy removal. Other objects and

1 advantages of the present invention will be readily apparent to those of skill in the art
2 from the following drawings and description of the preferred embodiments.

3 **BRIEF DESCRIPTION OF THE DRAWINGS**

4 Figure 1 is an isometric view of the sheet metal cable hook of the present
5 invention.

6 Figure 2 is a side view of the invention installed in a metal sheet which is
7 shown in phantom lines.

8 Figure 3 is an isometric view of the sheet metal cable hook mounted on a
9 vertical panel shown in phantom lines with the cable-tie and wiring-bundle.

10 Figure 4 is a left side isometric view of an alternate embodiment including a
11 plastic insert.

12 Figure 5 is a left side isometric view showing an alternate embodiment which
13 utilizes a grommet-type insert.

14 Figure 6 is a left side isometric view of an alternate embodiment which includes
15 a catch covering the opening of the hook portion of the fastener.

16 Figure 7 is a left side view of a second alternate embodiment incorporating a
17 spring-biased hook covering the opening of the fastener.

18 **DESCRIPTION OF THE PREFERRED EMBODIMENTS**

19 Referring to Figure 1, the present invention 10 is a metal, self-clinching
20 fastener. A base 17 is substantially rectangular and flat, and includes clinch features,
21 deformer 18 and undercut 16 which are provided at opposite sides. An upper portion
22 of the fastener includes two curved jaws 21 and 23 which form a "C"-shaped hook

1 having a lateral opening 15 that is substantially circular. Upper jaw 21 is an arcuate
2 hook extending from the lower portion or base 17 of the fastener which includes lower
3 jaw 23. The upper portion, or hook, of the fastener including curved jaws 21 and 23 is
4 of uniform, lateral thickness. A frontal opening 22 between the ends of the jaws may
5 be sized to closely receive a cable-tie or similar structure of rectangular cross-section,
6 sideways. The hook formed by jaws 21 and 23 has a continuous arcuate inside surface
7 except for notch 20. Notch 20 helps to prevent unintentional removal of the cable-tie
8 due to vibration. Orientation marks 12 on the bottom of the base 17 allow for easy
9 identification of the cable-tie receiving end of the fastener when it is being installed
10 from the opposite side of the attached metal sheet if the hook portion is not visible to
11 the installer.

12 Figure 2 shows the fastener 10 installed in a metal sheet 19. Fastener 10 is
13 pressed into a rectangular opening in metal sheet 19 until the flat base 17 is flush with
14 the insertion side of the sheet. When fully installed, the deformer 18 displaces a
15 portion of the metal sheet 19 into the undercut 16 thereby embedding the clinch
16 features and locking the fastener 10 into the sheet. The hook portion includes a lateral
17 opening 15 and a frontal opening or mouth 22 between the jaws at the front of the
18 fastener. Notch 20 is included on the inside of the upper jaw 21 near its end.
19 Orientation marks 12 are positioned toward the front end of the fastener and are
20 visible from the opposite side of the sheet to ensure that the fastener is properly
21 oriented when installed.

22 Figure 3 shows fastener 10 in the position installed on a vertical wall in a

1 cabinet or similar enclosure 19 with the hook opening 22 in an upward-facing position.
2 As depicted, the cable-tie 30 has been fitted over the jaw 21 and is hanging from the
3 fastener and wrapped around the wiring-bundle 40 in the normal manner. The cable-
4 tie 30 shown is an industry standard version that is normally screw-mounted by a
5 through-hole 32 in portion 31. The hook of the fastener is carefully sized so that the
6 thickness of the screw-mounting portion 31 is greater than the dimension of opening
7 22. Therefore, the cable-tie through-hole must be rotated at an angle over jaw 21 of
8 the fastener to achieve attachment. This careful sizing of the hook opening and cable-
9 tie thickness ensures that the cable-tie will not readily separate from the fastener
10 during normal use because a compound motion is required to remove it from between
11 the jaws of the hook. Once received, the structure is permitted some degree of
12 movement within the hook opening but it is not easily removed between the jaws.

13 The embodiment shown in Figures 1-3 typifies the simplest version of the
14 present invention which, as it will be understood by those of skill in art, may be used
15 for many different applications and oriented in different ways. For example, the
16 fastener may be applied to either horizontal or vertical surfaces. In the case of
17 attachment to a vertical surface, the opening of the hook may face downward while
18 still retaining the cable-tie. Furthermore, it may be used to attach many other items
19 such as a spring, a rod, tubing, or a shaft. The uses of the invention are limited only by
20 the imagination of one employing the device.

21 Figures 4-7 depict alternate embodiments of the invention. Figure 4 shows an
22 isometric and side view of fastener 10 with an added plastic insert 40 encompassing

1 the inside surface of the jaws. The plastic insert wraps around the lateral sides of the
2 fastener adjacent opening 15 to provide abrasion resistance and electrical insulation
3 between an item that is inserted through the opening and the fastener jaws while the
4 opening 22 remains unobstructed.

5 Figure 5 shows an isometric and side view of fastener 10 with a thermoplastic
6 insert or grommet 50 covering the fastener opening and the edges of the jaws around
7 it. The grommet 50 is tubular and closes opening 22.

8 Figure 6 shows fastener 10 further including a flexible plastic insert 60. Flap
9 61 of plastic insert 60 covers the frontal opening 22 of fastener 10 and pivots at point
10 63 while biased to contact the upper jaw 21 at point 65 due to its shape memory.
11 Feature 64 of the plastic insert serves two functions, it provides a stop for the motion
12 of flap 61 in the closing direction and it also keeps the plastic insert from rotating
13 around lateral opening 15. The plastic insert 60 also serves to cover the metal surfaces
14 around the lateral opening 15 for abrasion resistance and electrical insulation. In this
15 way, a clip is formed to positively retain an item such as a cable-tie loop which passes
16 through the lateral hook opening. Items retained by the hook may be released by
17 depressing the flap in the usual way.

18 Figure 7 shows a side view of fastener 10 including a formed metal insert 70.
19 The insert provides a spring-biased catch 72 covering the opening 22 at the front of
20 the fastener so that the hook portion, as in the previous embodiment, forms a spring
21 clip and items inserted through the opening of the hook may not be removed from the
22 front without assistance. The insert 70 is pivoted at point 73 and is biased against the

1 upper jaw 21 at point 74. The metal insert includes two opposing ears 76 which have
2 inward-facing dimples that cooperate with like dimensioned recesses on opposite sides
3 of the lower jaw 23 to achieve the pivot point 73. This combination of mechanical
4 structures holds the insert laterally and provides a snap-fit attachment of the insert to
5 the hook. The closing force is provided by spring portion 71 that includes a tail 75
6 which is free to slide against the inside surface of the lower jaw 23. Items which pass
7 through the hook opening may only be removed from the opening of the hook after
8 the catch has been depressed as required in the usual clip attachment/release fashion.
9 The insert 70 may also be formed of plastic.

10 It should be understood that there may be other modifications and changes to
11 the present invention that will be obvious to those of skill in the art from the foregoing
12 description, however, the present invention should be limited only by the following
13 claims and their legal equivalents.